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DOE OFFICE OF ENVIRONMENTAL MANAGEMENT
TECHNICAL SOLUTIONS TEAM FOR THE CLOSURE OFFICE

CHARACTERIZATION OF VOC CONTAMINATION ASSOCIATED WITH THE 18-INCH OUTFALL LINES AT THE ASHTABULA ENVIRONMENTAL MANAGEMENT FACILITY USING THE MEMBRANE INTERFACE PROBE: DATA AND SUMMARY REPORT

TECHNICAL ASSISTANCE # *NT031102-006*

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Characterization of VOC contamination associated with the 18-Inch Outfall Lines at the Ashtabula Environmental Management Facility using the Membrane Interface Probe: Data and Summary Report

EXECUTIVE SUMMARY

In October 2002, technical assistance was requested by Ashtabula Environmental Project (ACP) to address a specific recommendation of the Ohio Closure Sites Technical Solutions team (Recommendation to Address Contaminated Soils, Concrete, and Corrective Action Management Unit/Groundwater Contamination at Ashtabula, OH, Technical Assistance Ohio Closure Sites Final Report, August 2002). ACP needed to better understand the nature of TCE contamination at the ACP. The Technical Solutions had recommended the use of direct push sensor techniques to further delineate TCE-contamination at the site. A Membrane Interface Probe (MIP) and Savannah River Technology Center (STRC) personnel were sent to ACP for two weeks in December to assist with characterization of a 18-inch sewer outfall line.

The MIP was used with a Geoprobe (Model 66DT) to detect locations where TCE might be present along the outfall line. The samples were taken 2 ft on either side of the outfall unless otherwise designated. A total of 23 readings were taken with the MIP. The FEP area (BH10), where the MIP response, was calibrated was the only location where significant contamination was detected. TCE was measured beginning at 4.2 ft and continued to the bottom of the borehole at 16.2 ft and ranged up to 835.8 ppmv. The MIP did not detect VOCs along the sampling transects. This does not exclude contamination along the utility lines, contamination may be present at concentrations lower than the sensitivity of the MIP and PID combination. However the data show that significant levels of VOCs were not present at the push locations.

1.0 INTRODUCTION

The Ashtabula Closure Project (ACP), located in Ashtabula, Ohio, approximately 60 miles east of Cleveland, has sediments and groundwater contaminated with both radiological and hazardous materials resulting from historic manufacturing operations involving the fabrication of nuclear materials for the U.S. Department of Energy (DOE). DOE has initiated a program to provide technical assistance to the Ohio DOE sites including Ashtabula Environmental Management Facility that are scheduled for closure in 2006.

As part of the Ohio Closure Sites Technical Solutions, a technical assistance team visited ACP in June 2002 and provided a general review of environmental activities (Recommendations to Address Contaminated Soils, Concrete, and Corrective Action Management Unit/Groundwater Contamination at Ashtabula, Ohio, Technical Assistance Ohio Closure Sites Final Report, August 2002). A specific recommendation of the team was to investigate the use direct-push technology with a volatile organic contaminant (VOC)-sensor to characterize areas contaminated with VOC's. In Fall 2002, it was determined that dditional characterization information was required along an 18-inch outfall line.

The 18-inch-diameter (ca. 12-16 feet deep) outfall line collected storm water and treated effluent from the wastewater treatment plant. The primary section of line that was investigated is ca. 560 feet long (extending from manhole 11 to manhole 1) and a secondary section that is ca. 150 feet (extending from manhole 2 to manhole 1). Monitoring required by the site's NPDES Permit since 1999, measured concentrations of TCE in the outfall effluent. The Former Evaporation Pond (FEP) Waste Management Unit (WMU), previously referred to as the Corrective Action Management Unit (CAMU), was thought to be the source of the TCE-contamination to the outfall. In August 2002, the outfall lines were plugged (sealed) and bypassed to control migration of TCE through the outfall lines.

The site requested technical assistance in October to better define the nature and extent of TCE contamination associated with the outfall lines (18 inch diameter). A Membrane Interface Probe (MIP) and Savannah River Technology Center (STRC) personnel were sent to ACP for two weeks in December to assist with characteriziation activities designed to determine of the distribution of TCE- contaminated groundwater and sediments associated with the 18-inch outfall lines.

2.0 SAMPLING STRATEGY

A work plan to characterize the sewer line was issued by RMI Environmental Services (Work Plan for the Investigation of Soil and Groundwater Contamination Associated with the Buried 18-inch Outfall Lines, RDP-ENV-013, Rev. 0, 12/3/02). Subsurface field reconnaissance investigations were conducted within two distinct areas. The initial area of investigation included the east-west trending utility conduit that extends between manhole #1 (MH1) and manhole #11 (MH11), and a southwest-northeast trending utility conduit that extends between manhole #2 (MH2) and manhole #1 (MH1) (Figure 1).

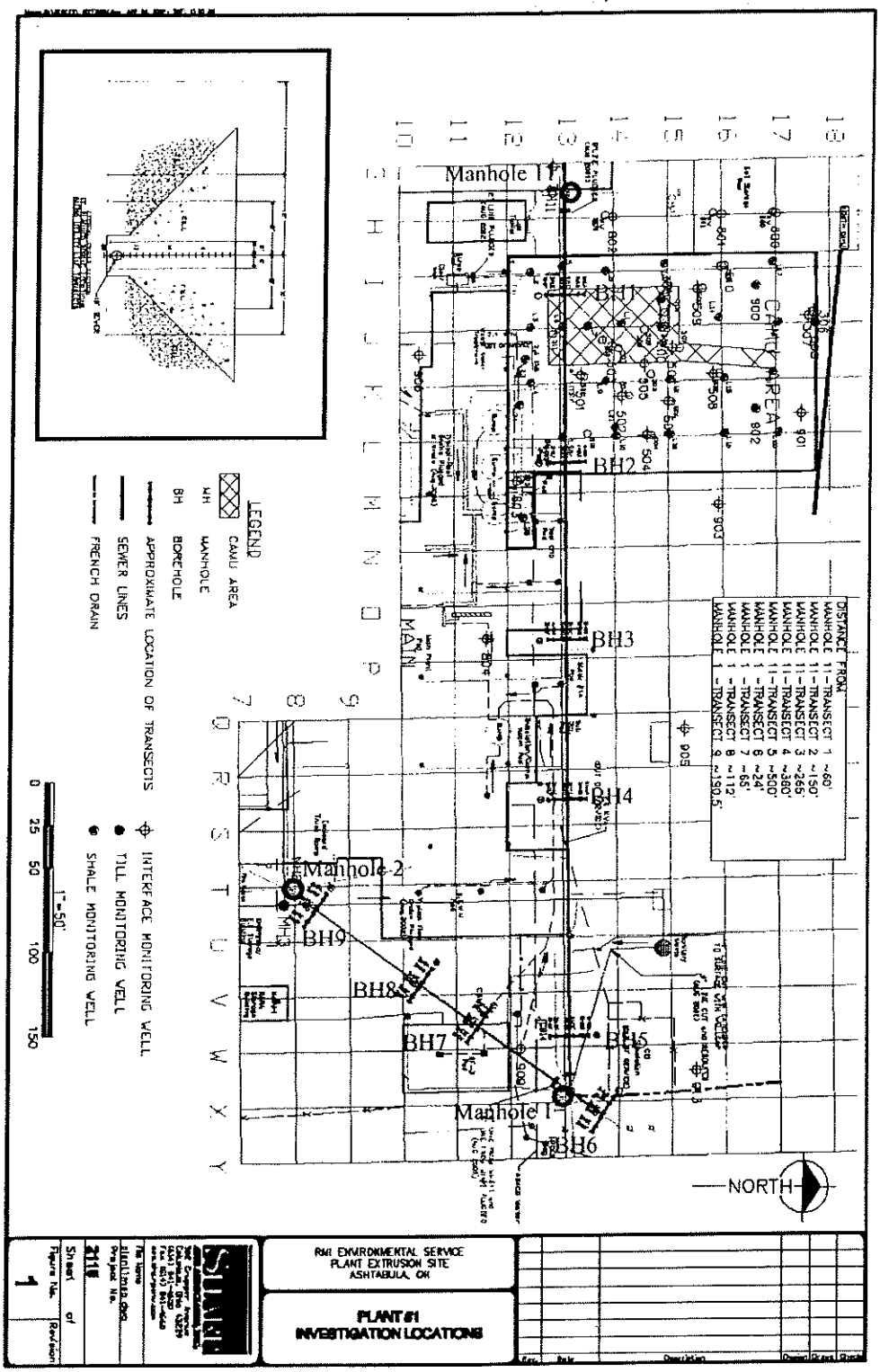

Figure 1. Map of Sampling Traverses

A DOE-owned Geoprobe pneumatic hammer push rig (Model 66DT) and the MIP were used to screen for VOCs followed with soil sampling for lithology and laboratory analysis. The investigation of the areas between MH1 to MH11, and MH2 to MH11, consisted of a series of nine (9) transects oriented perpendicular to the course of the utility pathways and labeled BH1-5 and BH6-9. Six (6) investigative and sampling locations were spaced along each of the 9 transects labeled A-F. Locations A and F, were located 12 ft on each side of the outfall pipe centerline. Locations B and E were located 8 ft on each side of the pipe centerline. Locations C and D were located 2 ft from the pipe centerline (see cross section detail on Figure 1).

The MIP was used at two locations along each transect nearest to the utility line (C and D). The penetration depth was planned to be 21 ft, two feet below the invert elevation of the outfall line estimated to be 18-feet below existing grade (Sharp and Associates, Sampling and Analysis Plan for the Phase II Groundwater Investigation at the RMI Extrusion Plant, 2002).

3.0 METHODS

The MIP is a probe designed to collect *in-situ* samples of VOCs from the subsurface. The MIP is deployed into the subsurface using direct push techniques. The MIP device uses a heated, semi-permeable membrane, installed in the wall of the probe, to collect vapor-phase VOC samples from the subsurface materials adjacent to the probe. The VOC sample is transferred to the surface for chemical analysis through a tube using an inert carrier gas (nitrogen). For the work at Ashtabula, the STRC provided two field based measurement systems. The first system coupled a Geoprobe MIP tip with a Photo Ionization Detector (PID). The PID was sensitive to 0.5 ppmv of VOC's. In addition, SRTC provided a Bruel and Kjaer photoacoustic analyzer (B&K Model 1312) that was used to analyze gas samples in the field. This instrument is slightly more sensitive then the PID but is capable of speciating and quantifying chlorinated compounds in a gaseous mixture.

A Tedlar bag of soil gas was collected from the MIP transfer tube and then analyzed by the B&K instrument to verify the PID results and speciate chlorinated compounds in the sample. The PID is a non-specific detector that will respond to many types of organic compounds such as BTEX, fuels, etc.. Since the MIP equipment was being housed out of an operating minivan, it was important to be able to ensure that ambient gases (e.g., exhaust fumes, humidity) were not affecting the results. Each bag analyzed by the B&K was composed of soil gas from several contiguous depths as a check on the results of the PID. Because the Tedlar bag contained a composite of soil gas from several depths, the B&K results were generally lower than those of the PID (Appendix A).

The MIP controller monitored and maintained the temperature of the membrane on the MIP at 60 degrees Celsius and the flow of nitrogen through the MIP at 70ml/min. The B&K, MIP controller and PID were housed in a vehicle and driven close to the each transect location. The vehicle was moved as the Geoprobe rig progressed to each transect. All measurements were taken in the vehicle to prevent contamination of

equipment and personnel, as well as to provide a barrier from the elements (temperature was below freezing during the field activities). The MIP, PID, and B&K gas analyzer were operated according to manufacturer's operating procedures. Calibration checks were performed prior to and after deployment. One push to a depth of 17 ft was made in the FEP area in a location known to be a hotspot (BH10) to demonstrate the response of the MIP to VOC's in the subsurface. BH10 was located approximately 12 ft west of monitoring well 503. The response of the MIP was checked at the surface, before pushing and after the last borehole, using approximately 5 microliters of liquid TCE applied directly to the membrane.

The initial calibration check established a response time of approximately 35 seconds between the time the probe reached a specific depth and a response by the PID. The lag time was the time it took for the gas to flow up the transfer tube (umbilical) from the MIP membrane and into the PID. This lag time was confirmed in the field at penetration BH10. For each location the probe was pushed one foot at a time, stopping for 35 seconds between one-foot depths. If the PID detected VOC's the probe was not advanced until the PID concentrations reached a maximum. This value was recorded and then the probe was pushed down another foot. This procedure was followed at each location to a depth of 21 ft. If VOC's were detected by the PID at the 2 ft spacings along the transect (i.e. borings C and D), borings would be performed further out along the transect (8 ft, and 12 ft from the sewer line).

The initial four feet of each borehole was pre-pushed using a blank tip (dummy tip) to prevent damage to the MIP from the vibrations caused by pneumatic hammering. The membrane was offset from the Geoprobe tip by 0.8 ft. The data attached to this report were corrected for that offset (Appendix A). Additional gas samples were collected in a Tedlar bag and analyzed in the field using the B&K photoacoustic analyzer for a series of depths at each location.

4.0 RESULTS AND DISCUSSION

The FEP area (BH10) was the only location where significant contamination was detected. PID readings began at 4.2 ft and continued to the bottom of the borehole at 16.2 ft (Table 1). The highest PID reading was 835.8 ppmv at 11 ft. The highest reading of TCE measured by the B&K was for a bag sample containing soil gas from depths between 10.2-12.2 ft (27ppmv). The B&K also detected small amounts of TCE in BH1C, although the PID read 0.0 ppmv. The TCE concentrations measured by the B&K were 0.5 ppmv between 0.8 ft – 12.2 ft and 0.2 ppmv between 13.2 and 20.2 ft. For all other transects BH1-BH9 locations C and D, contamination was not detected by the MIP system (Table 2-9). In addition, no VOC contamination was detected at locations BH1A, BH6A, and BH6B.

Two incidents of equipment failure delayed progress during the initial fieldwork. Equipment failure was due to excessive vibrations damaging the MIP sensor caused by the pneumatic hammer of the Geoprobe 66DT rig. Geoprobe advises against using the 66DT rig to push the MIP probe, however the current literature or manuals do not

document this warning . After several helpful discussions with the staff at Geoprobe a procedure was developed to protect the MIP probe using the 66DT rig. The procedure required a 4-foot prepush using a dummy tip. Followed by removing the rods and attaching the MIP for the rest of the push. Vibrations are damped the further the MIP probe is from the pneumatic hammer (the more steel rods between the MIP and the hammer). Once the operational procedures for using the MIP in the Ashtabula sediments were determined, 16 boreholes were completed in two days.

5.0 CONCLUSION

Although the MIP did not detect VOCs along the sampling transects, the measurements do not preclude contamination along the utility lines. Contamination may be present at concentrations lower than the sensitivity of the MIP and PID combination, however the data show that significant levels of VOCs (0.1 mg/kg (ppm)or greater – approximately twice the detection limit concentration for the MIP system) were not present at the push locations.

The Geoprobe MIP configuration used during this activity shows promise for rapid, cost effective, three-dimensional refinement of the source term in the FEP area or other areas with higher VOC contamination.

Ashtabula Site MIP results			Date: 12/10/02		
Location: BH2C			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
15:29	3	2.2	0	B&K1	
15:31	4	3.2	0		
15:32	5	4.2	0		
15:34	6	5.2	0		
15:35	7	6.2	0		
15:36	8	7.2	0		
15:37	9	8.2	0		
15:38	10	9.2	0		
15:39	11	10.2	0		
15:40	12	11.2	0		
15:42	13	12.2	0	B&K1 – TCE	0ppmv
15:43	14	13.2	0		
15:44	15	14.2	0		
15:45	16	15.2	0		
15:46	17	16.2	0		
15:47	18	17.2	0		
15:48	19	18.2	0		
15:50	20	19.2	0		
15:53	21	20.2	0	B&K2 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Location: BH2D			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
14:33	3	2.2	0	B&K1	
14:37	4	3.2	0		
14:38	5	4.2	0		
14:39	6	5.2	0		
14:41	7	6.2	0		
14:42	8	7.2	0		
14:43	9	8.2	0		
14:45	10	9.2	0		
14:46	11	10.2	0		
14:48	12	11.2	0		
14:49	13	12.2	0	B&K1 – TCE	0ppmv
14:51	14	13.2	0		
14:52	15	14.2	0		
14:55	16	15.2	0		
14:56	17	16.2	0		
14:58	18	17.2	0		
15:00	19	18.2	0		
15:07	20	19.2	0		
15:11	21	20.2	0	B&K2 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Ashtabula Site MIP results			Date: 12/10/02		
Location: BH3C			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
16:12	4	3.2	0	B&K1	
16:13	5	4.2	0		
16:17	6	5.2	0		
16:18	7	6.2	0		
16:19	8	7.2	0		
16:20	9	8.2	0		
16:21	10	9.2	0		
16:22	11	10.2	0		
16:23	12	11.2	0		
16:23	13	12.2	0	B&K1 – TCE	0ppmv
16:25	14	13.2	0		
16:25	15	14.2	0		
16:27	16	15.2	0		
16:28	17	16.2	0		
16:29	18	17.2	0		
16:30	19	18.2	0		
16:31	20	19.2	0		
16:32	21	20.2	0	B&K2 – TCE	0ppmv
				Out of hole, no rads, VOCs.	

Ashtabula Site MIP results			Date: 12/11/02		
Location:	BH3D		Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
7:52	3	2.2	0	B&K1	
7:54	4	3.2	0		
7:55	5	4.2	0		
7:56	6	5.2	0		
7:57	7	6.2	0		
7:58	8	7.2	0		
7:58	9	8.2	0		
7:59	10	9.2	0		
8:00	11	10.2	0		
8:01	12	11.2	0		
8:02	13	12.2	0		
8:03	14	13.2	0		
8:03	15	14.2	0		
8:04	16	15.2	0		
8:05	17	16.2	0		
8:06	18	17.2	0		
8:07	19	18.2	0		
8:08	20	19.2	0		
8:09	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs.	

Ashtabula Site MIP results			Date: 12/11/02		
Location:	BH4C		Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
8:29	4	3.2	0	B&K1	
8:30	5	4.2	0		
8:31	6	5.2	0		
8:32	7	6.2	0		
8:33	8	7.2	0		
8:34	9	8.2	0		
8:35	10	9.2	0		
8:35	11	10.2	0		
8:36	12	11.2	0		
8:37	13	12.2	0		
8:38	14	13.2	0		
8:39	15	14.2	0		
8:40	16	15.2	0		
8:41	17	16.2	0		
8:42	18	17.2	0		
8:43	19	18.2	0		
8:44	20	19.2	0		
8:46	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Location:	BH4D		Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
9:02	4	3.2	0	B&K1	
9:03	5	4.2	0		
9:04	6	5.2	0		
9:05	7	6.2	0		
9:05	8	7.2	0		
9:06	9	8.2	0		
9:07	10	9.2	0		
9:08	11	10.2	0		
9:09	12	11.2	0		
9:10	13	12.2	0		
9:10	14	13.2	0		
9:11	15	14.2	0		
9:12	16	15.2	0		
9:13	17	16.2	0		
9:14	18	17.2	0		
9:15	19	18.2	0		
9:16	20	19.2	0		
9:18	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Ashtabula Site MIP results			Date: 12/11/02		
Location: BH5C			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
9:39	4	3.2	0	B&K1	
9:40	5	4.2	0		
9:41	6	5.2	0		
9:41	7	6.2	0		
9:42	8	7.2	0		
9:43	9	8.2	0		
9:44	10	9.2	0		
9:45	11	10.2	0		
9:45	12	11.2	0		
9:46	13	12.2	0		
9:47	14	13.2	0		
9:48	15	14.2	0		
9:49	16	15.2	0		
9:50	17	16.2	0		
9:50	18	17.2	0		
9:51	19	18.2	0		
9:53	20	19.2	0		
9:54	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Location:	BH5D		Membrane offset from tip =		0.8
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
10:48	4	3.2	0	B&K1	
10:50	5	4.2	0		
10:51	6	5.2	0		
10:52	7	6.2	0		
10:52	8	7.2	0		
10:53	9	8.2	0		
10:54	10	9.2	0		
10:55	11	10.2	0		
10:56	12	11.2	0		
10:56	13	12.2	0		
10:57	14	13.2	0		
10:58	15	14.2	0		
10:59	16	15.2	0		
10:59	17	16.2	0		
11:00	18	17.2	0		
11:02	19	18.2	0		
11:03	20	19.2	0		
11:05	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Ashtabula Site MIP results			Date:	12/4/02	
Location:	BH6A		Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
13:31	1	0.2	0		
13:32	2	1.2	0		
13:32	3	2.2	0		
13:34	4	3.2	0		
13:35	5	4.2	0		
13:36	6	5.2	0		
13:39	7	6.2	0		
13:40	8	7.2	0		
13:40	9	8.2	0		
13:42	10	9.2	0	Began Tedlar bag sample	
13:43	11	10.2	0		
13:43	12	11.2	0		
13:45	13	12.2	0		
13:46	14	13.2	0		
13:48	15	14.2	0		
13:52	16	15.2	0	Geoprobe hammer not working	
13:59	17	16.2	0	properly – manual operation	
14:03	18	17.2	0	End Tedlar bag sample – pump	
14:06	19	18.2	0	on B&K not working.	
14:15	20	19.2	0		
14:19	20.5	19.7	0	Out of hole, no rads, VOCs.	

Location:	BH6B		Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
14:37	1	0.2	0		
14:38	2	1.2	0		
14:39	3	2.2	0		
14:40	4	3.2	0		
14:41	5	4.2	0		
14:42	6	5.2	0		
14:43	7	6.2	0		
14:44	8	7.2	0		
14:45	9	8.2	0		
14:46	10	9.2	0		
14:47	11	10.2	0		
14:48	12	11.2	0		
14:49	13	12.2	0		
14:50	14	13.2	0		
14:51	15	14.2	0		
14:52	16	15.2	0		
14:53	17	16.2	0		
14:54	18	17.2	0		
14:55	19	18.2	0		
14:56	20	19.2	0		
14:57	21	20.2	0	Out of hole, no rads, VOCs.	

Ashtabula Site MIP results			Date: 12/4/02		
Location: BH6C			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
15:14	1	0.2	0		
15:15	2	1.2	0		
15:15	3	2.2	0		
15:16	4	3.2	0		
15:17	5	4.2	0		
15:18	6	5.2	0		
15:19	7	6.2	0		
15:20	8	7.2	0		
15:21	9	8.2	0		
15:22	10	9.2	0		
15:23	11	10.2	0		
15:23	12	11.2	0		
15:25	13	12.2	0		
15:26	14	13.2	0		
15:26	15	14.2	0		
15:28	16	15.2	0		
15:33	17	16.2	0		
15:33	18	17.2	0		
15:35	19	18.2	0		
15:36	20	19.2	0		
15:37	21	20.2	0	Out of hole, no rads, VOCs	

Location: BH6D			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
15:52	1	0.2	0		
15:53	2	1.2	0		
15:54	3	2.2	0		
15:55	4	3.2	0		
15:56	5	4.2	0		
15:56	6	5.2	0		
15:58	7	6.2	0		
15:59	8	7.2	0		
15:59	9	8.2	0		
16:01	10	9.2	0		
16:02	11	10.2	0		
16:02	12	11.2	0		
16:03	13	12.2	0		
16:04	14	13.2	0		
16:05	15	14.2	0		
16:06	16	15.2	0		
16:07	17	16.2	0		
16:08	18	17.2	0		
16:09	19	18.2	0		
16:10	20	19.2	0		
16:11	21	20.2	0	Out of hole, no rads, VOCs	

Ashtabula Site MIP results			Date: 12/11/02		
Location: BH7C			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
15:29	4	3.2	0	B&K1	
15:30	5	4.2	0		
15:31	6	5.2	0		
15:31	7	6.2	0		
15:32	8	7.2	0		
15:33	9	8.2	0		
15:34	10	9.2	0		
15:34	11	10.2	0		
15:35	12	11.2	0		
15:36	13	12.2	0		
15:37	14	13.2	0		
15:38	15	14.2	0		
15:39	16	15.2	0		
15:40	17	16.2	0		
15:41	18	17.2	0		
15:42	19	18.2	0		
15:44	20	19.2	0		
15:45	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Location: BH7D			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
14:57	4	3.2	0	B&K1	
14:59	5	4.2	0		
14:59	6	5.2	0		
15:00	7	6.2	0		
15:01	8	7.2	0		
15:02	9	8.2	0		
15:03	10	9.2	0		
15:03	11	10.2	0		
15:04	12	11.2	0		
15:05	13	12.2	0		
15:06	14	13.2	0		
15:07	15	14.2	0		
15:08	16	15.2	0		
15:09	17	16.2	0		
15:10	18	17.2	0		
15:11	19	18.2	0		
15:14	20	19.2	0		
15:15	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Ashtabula Site MIP results			Date: 12/11/02		
Location: BH8C			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
14:24	4	3.2	0	B&K1	
14:25	5	4.2	0		
14:25	6	5.2	0		
14:26	7	6.2	0		
14:27	8	7.2	0		
14:28	9	8.2	0		
14:29	10	9.2	0		
14:30	11	10.2	0		
14:30	12	11.2	0		
14:31	13	12.2	0		
14:32	14	13.2	0		
14:33	15	14.2	0		
14:34	16	15.2	0		
14:35	17	16.2	0		
14:36	18	17.2	0		
14:37	19	18.2	0		
14:39	20	19.2	0		
14:40	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Location: BH8D			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
13:50	4	3.2	0	B&K1	
13:51	5	4.2	0		
13:51	6	5.2	0		
13:52	7	6.2	0		
13:53	8	7.2	0		
13:54	9	8.2	0		
13:54	10	9.2	0		
13:55	11	10.2	0		
13:56	12	11.2	0		
13:57	13	12.2	0		
13:58	14	13.2	0		
13:58	15	14.2	0		
13:59	16	15.2	0		
14:00	17	16.2	0		
14:01	18	17.2	0		
14:02	19	18.2	0		
14:05	20	19.2	0	B&K1 – TCE	0ppmv
Refusal				Out of hole, no rads, VOCs	

Ashtabula Site MIP results			Date: 12/11/02		
Location: BH9C			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
13:07	4	3.2	0	B&K1	
13:08	5	4.2	0		
13:09	6	5.2	0		
13:10	7	6.2	0		
13:10	8	7.2	0		
13:11	9	8.2	0		
13:12	10	9.2	0		
13:13	11	10.2	0		
13:13	12	11.2	0		
13:14	13	12.2	0		
13:15	14	13.2	0		
13:16	15	14.2	0		
13:17	16	15.2	0		
13:18	17	16.2	0		
13:19	18	17.2	0		
13:20	19	18.2	0		
13:21	20	19.2	0		
13:22	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Location: BH9D			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
11:30	4	3.2	0	B&K1	
11:31	5	4.2	0		
11:32	6	5.2	0		
11:33	7	6.2	0		
11:34	8	7.2	0		
11:35	9	8.2	0		
11:35	10	9.2	0		
11:36	11	10.2	0		
11:37	12	11.2	0		
11:38	13	12.2	0		
11:39	14	13.2	0		
11:40	15	14.2	0		
11:40	16	15.2	0		
11:41	17	16.2	0		
11:42	18	17.2	0		
11:43	19	18.2	0		
11:45	20	19.2	0		
11:46	21	20.2	0	B&K1 – TCE	0ppmv
				Out of hole, no rads, VOCs	

Ashtabula Site MIP results			Date: 12/9/02		
Location: BH10			Membrane offset from tip = 0.8		
Time	Tip Depth	Membrane Depth (ft)	PID (ppm)	Comments	
8:22	1	0.2	0	B&K1	
8:24	2	1.2	0		
8:25	3	2.2	0		
8:27	4	3.2	0		
8:30	5	4.2	40.5	B&K1 – TCE	1ppmv
8:32	6	5.2	65.4		
8:36	7	6.2	182.1		
8:38	8	7.2	275.4		
8:40	9	8.2	463.2		
8:43	10	9.2	653	B&K2 – TCE	12ppmv
8:46	11	10.2	835.3		
8:48	12	11.2	568.7		
8:50	13	12.2	314.8	B&K3 – TCE	27ppmv
8:52	14	13.2	187		
8:54	15	14.2	189.1		
8:55	16	15.2	112.2		
16:07	17	16.2	70	B&K4 – TCE	11ppmv
				Out of hole, no rads	